MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

ECP3086 – MULTIMEDIA TECHNOLOGY AND APPLICATIONS

(RE and BE)

23 OCTOBER 2017
9.00a.m -11.00a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 7 pages with 4 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

a) With the increasing demand for online purchasing, multimedia system is one of the factor involve in sustaining in current market trend. Discuss **FOUR** features of multimedia system that a company should have for an online business.

[8 marks]

b) Construct HTML codes as Figure Q1 below. Provide the link to HERE ("https:mmls.mmu.edu.my").

TRIMESTER 1 2017/2018

MULTIMEDIA TECHNOLOGY AND APPLICATIONS

Please download your notes HERE

ECP3086

	8-10	10-12	2-4	4-6
MONDAY			MSMR3016	
TUESDAY	LAB			

Figure Q1

[6 marks]

c) A string consisting of the symbols [I,A,M,N,U] is to be compressed.

IAMMMMUIANMMUIIUMUIM

Determine:

(i) The optimum encoded symbols by using Huffman coding.

[6 marks]

(ii) Average number of bits per codeword.

[1 mark]

(iii)Entropy of the source.

[2 marks]

(iv)The minimum number of bits required for each codeword if fixed length coding is used.

[1 mark]

(v) Efficiency of the above coding scheme.

[1 mark]

Continued...

Question 2

a) Explain **THREE** limitations of the colour sensory operators of human eye that can be exploited for the compression of colour images and video.

[6 marks]

b) Figure Q2 shows a DCT coefficient matrix that will be quantized by a 8x8 quantization matrix with the values 32.

DCT Coefficient Matrix

312	84	-72	12	1	2	-8	0
-92	10	64	1	1	0	-3	0
18	2	2	-1	0	0	0	0
-1	4	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Figure Q2

(i) Find the quantized DCT coefficient matrix and obtain the output of the Run-Length Coding (RLC) for the AC coefficient after zig-zag scanning.

[8 marks]

(ii) If the given DC coefficients for the first 6 blocks are 312,320,308,315,309, 310 what are the DPCM codes?

[5 marks]

(iii) Is the quantization operation a lossless or lossy process? Justify.

[2 marks]

(iv) Quantization and run length coding are used in JPEG image compression. Suggest **TWO** methods to increase the compression ratio.

[4 marks]

Continued...

Question 3

a) Figure Q3(a) shows the masking curves of several frequencies for a sound level of 60dB which affect the threshold of human hearing.

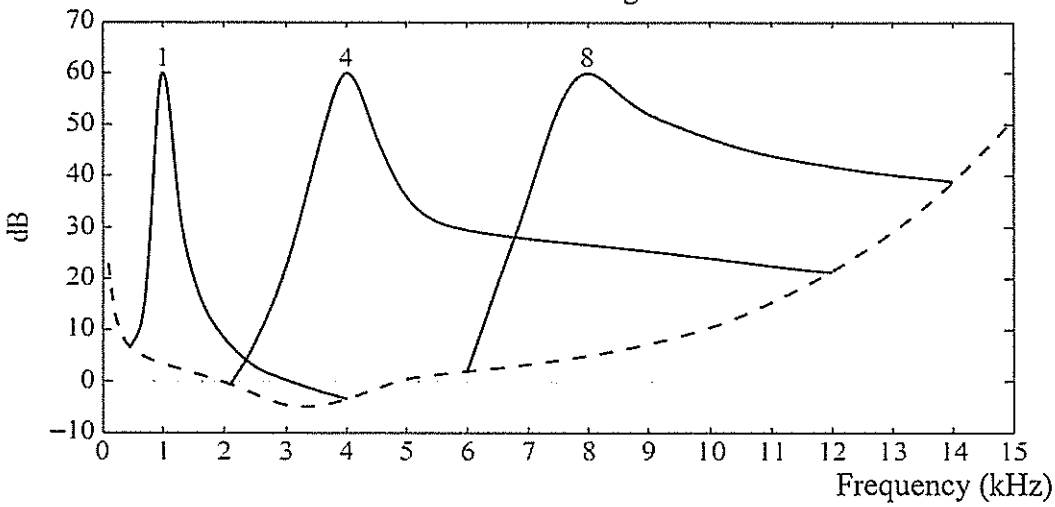

Figure Q3(a)

Consider the following sound levels:

- 20dB at 7kHz
- 40dB at 10kHz

For the two sounds levels above, analyze whether the sounds above are audible for the following conditions:

(i) Threshold of human hearing
(ii) The 1kHz frequency masking curve
(iii)The 4kHz frequency masking curve
(iv)The 8kHz frequency masking curve

[8 Marks]

b) Figure Q3(b) and Q3(c) show a block diagram of DPCM encoder and decoder respectively.

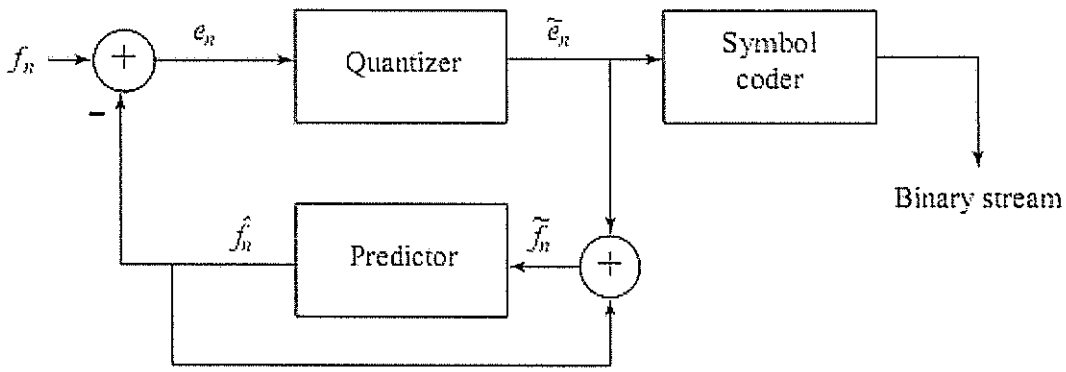

Figure Q3(b)

Continued...

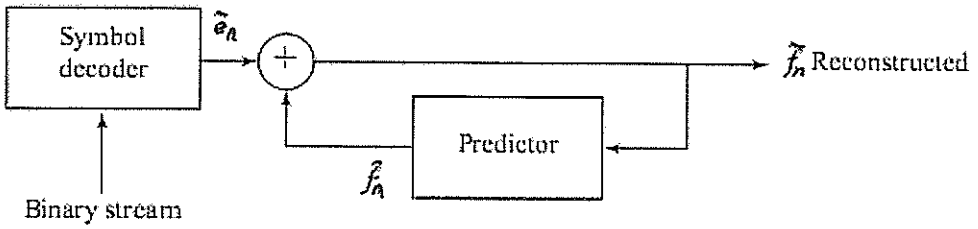

Figure Q3(c)

Consider a DPCM system uses a predictor and quantizer as given below,

$$\hat{f}_n = \text{fix}\left(\tfrac{1}{2}\left(\tilde{f}_{n-1} + \tilde{f}_{n-2}\right)\right)$$

$$\tilde{e}_n = Q[e_n] = 16 \times \text{fix}\left(\tfrac{1}{16}\left(255 + e_n\right)\right) - 256 + 8$$

Determine:

(i) The output from the encoder $\left(\hat{f}_n, e_n, \tilde{e}_n, \tilde{f}_n\right)$ if the input signal (f_n) has the following values.

f_1	f_2	f_3	f_4
92	128	168	144

[8 marks]

(ii) Show how the signals are reconstructed at the decoder side.

[9 marks]

Continued...

Question 4

a) In video compression, the raw video frames are converted to a sequence of I, P and B frames. Briefly compare I, P and B frames.

[6 marks]

b) Jitter is a problem that occurs during video streaming which in turn degrades the quality of the video. Explain jitter.

[2 marks]

c) Derive the memory requirement to store two minutes of uncompressed DVD video, using the following parameters.

(i) Frame rate : 25 frames per second
(ii) DVD video resolution : 720 x 576
(iii)Pixel depth : 24 bits per pixel

Also calculate the compression ratio achieved by MPEG-2 standard in DVD, by assuming that the video bitrate for DVD video is 6 Mbit/s.

[4 marks]

d) An original 8x8 colour "checkerboard" CMY image is shown as Figure Q4, in which the two colours are A1: (C = 255, M = 155, Y = 255) and A2: (C = M = Y = 100), where [0...255] is the range for the three colour components.

Convert the colour CMY image to YIQ image using 4:1:1 chroma subsampling using an averaging approach. Show all pixel values for each of the YIQ images generated from the given CMY color image.

A1	A1	A2	A2	A1	A1	A2	A2
A1	A1	A2	A2	A1	A1	A2	A2
A2	A2	A1	A1	A2	A2	A1	A1
A2	A2	A1	A1	A2	A2	A1	A1
A1	A1	A2	A2	A1	A1	A2	A2
A1	A1	A2	A2	A1	A1	A2	A2
A2	A2	A1	A1	A2	A2	A1	A1
A2	A2	A1	A1	A2	A2	A1	A1

Figure Q4

Note: The relationship between RGB and CMY, and RGB and YIQ is given as:

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} - \begin{bmatrix} C \\ M \\ Y \end{bmatrix}$$

Continued...

$$\begin{bmatrix} Y \\ I \\ Q \end{bmatrix} = \begin{bmatrix} 0.3 & 0.6 & 0.1 \\ 0.6 & -0.3 & -0.3 \\ 0.2 & -0.5 & 0.3 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

[13 marks]

End of paper